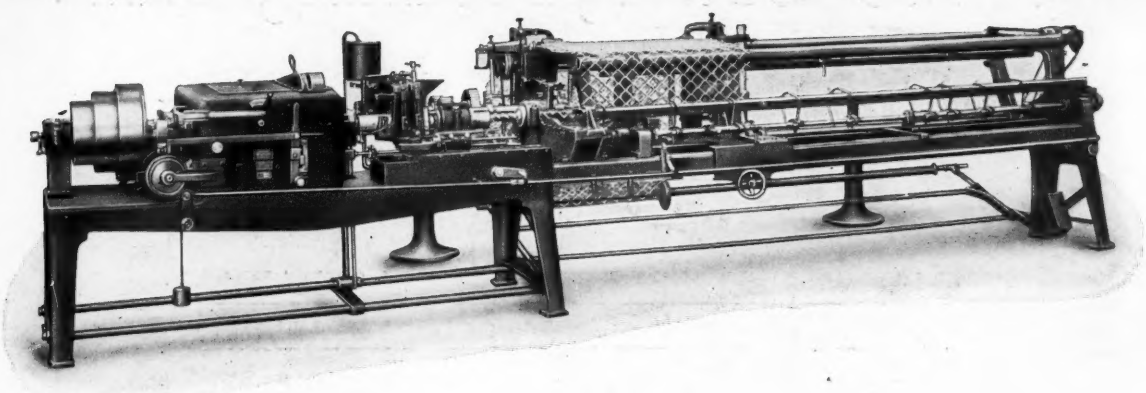
WIRE
& WIRE PRODUCTS

Exhibition---Cordial Invitation Extended to Inspect



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TWENTY five years ago, when System was first published, one man wrote to the publisher to the effect that he was sixty years old and that his value to his company lay in all the years of experience he had accumulated, and now a magazine was going to disclose all these secrets so that men twenty-five and thirty years of age would be able to read what it had taken him all his life to learn. Recently Mr. A. W. Shaw, publisher of the pioneer business magazine, has announced his conclusion that the interchange of ideas and information is the biggest thing that has happened in business in the last quarter of a century.

Unfortunately, the ultra-conservative attitude of twenty five years back still prevails among some manufacturers in wire and associated industries. We wish that all such might read the signs of the times and take to heart the message so well expressed by Mr. John I. Romer, in Executives Bulletin, in which he says that the key to American industrial progress is circulation of ideas.

He says "Old-fashioned traits of guarding business plans, refusing to exchange ideas and frankly discuss problems, have been practically banished from American business. Operations behind closed doors lock out indefinitely more than they lock in. The day is coming when business executives in all countries will appreciate the value of a free exchange of thoughts and experiences on all matters pertaining to management of their organizations."

It is precisely for such a free exchange, so far as its special field is concerned, that *Wire & Wire Products* exists. Its pages are open to the discussion of problems pertinent to the industries it serves, and communications from informed contributors are always welcome.

The Publishers.

WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 3 **July, 1928** **No. 7**

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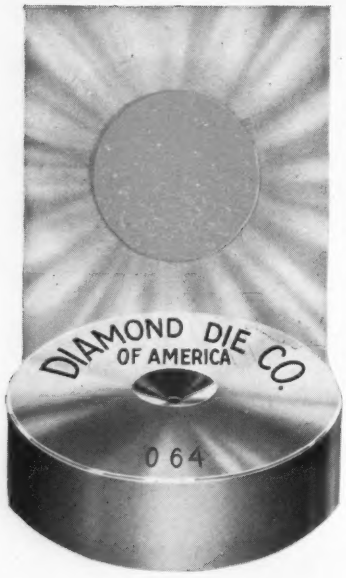

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WIRE & WIRE PRODUCTS

Vol. 3 JULY, 1928 No. 7

Government Fence Specifications Arouse Protest

Manufacturer of chain link fence and fabric charges discrimination against independent makers

A REPORT on its metallurgical tests with respect to fences has been requested from the Bureau of Standards by Senator Edwards, of New Jersey. The Senator's action arises from a complaint on the part of the Atlas Fence Company, of Newark, N. J. that Government standard specifications discriminate against independent manufacturers.

The Atlas company, in a letter of May 22 to Secretary Hoover, protested the effort to obtain general acceptance of the tentative standard specifications (corrected as of January 15, 1928), for chain link fence and chain link fabric, galvanized after weaving.

The full text of this letter follows:

"Our attention has been drawn to tentative standard specifications, corrected as of January 15, 1928, for chain link fence and chain link fabric, galvanized after weaving. This specification has apparently been sent out by your office widely with the effort apparently of making the recipient commit himself, promising to 'accept the original draft of the commercial standard, dated January 10, 1928, as our standard of practice in (Production), (Distribution), (Consumption) of chain link fence and chain link fabric, galvanized after weaving, for the year beginning January 15, 1928, and will use our best effort in securing its general adoption.'

IN acknowledging the correspondence here reported, the Bureau of Standards has replied that the protest will be "taken under consideration at the earliest possible moment". The Director of the Bureau also points out that it will be several years before official tests of chain link fence will be completed preliminary to adoption of a proposed commercial standard for fence manufacturers.

"This is an action that we cannot fully understand and construe it as an effort by your high office to practically serve as a sales agent for certain manufacturers. This, of course is undoubtedly due to the fact that you have been erroneously advised. For your information, if it is the purpose of standardizing, we believe it fair to all the manufacturers in the United States to be called in on a matter of this kind as well as the principal users or distributors.

"What is the purpose of standardizing or advocating the exclusive use of pipe, angle bars, or U-bars, the products of three distinct manufacturers? Also, what advantage is there in using galvanized after fabric? Who says it is better and by what authority do they speak? Who is to be the judge of what is standard and what is not standard?"

On June 11, the Atlas company wrote to both the Secretary of Commerce and to Senator Edwards. To the former, it stated that it seemed to the company that the Department is being used by competitors "in a way which makes it appear as an advocation by the Government that all fences be built in line with these specifications to the detriment and injury of independent fence companies."

"According to conversations we have had with some of the highest engineers who have received these specifications with this mimeographed letter," the company wrote, "they naturally conclude that the Department of Commerce—through possibly

(*Please turn to page 246*)

The Mechanical Testing of Wire

A variety of machines makes it possible to maintain high quality production by frequent, rapid and accurate tests

By J. D. Brunton

Brunton's Research Laboratory, Musselbergh, Scotland

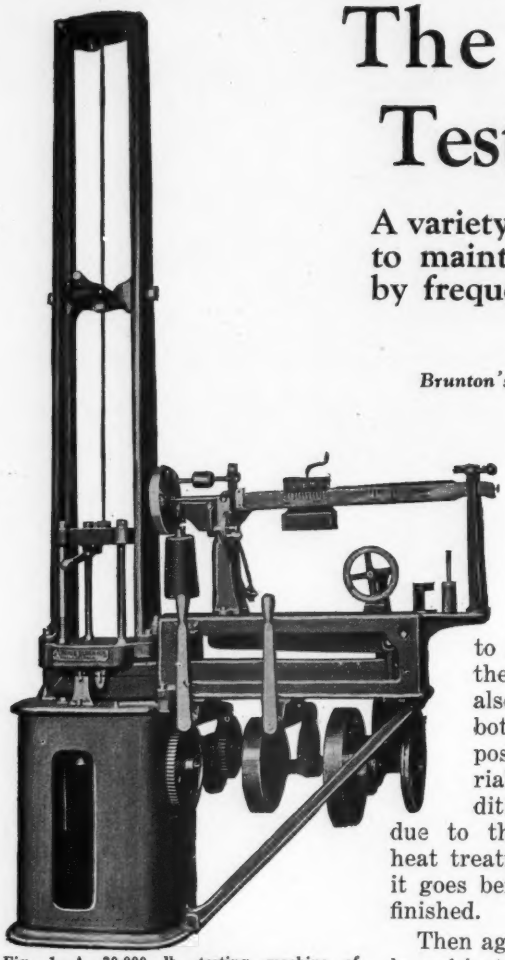


Fig. 1—A 30,000 lb. testing machine of American make. A combination of spur wheels may be driven directly by an electric motor or by a belt from a motor.

WHEN it is considered that wire is round there is little wonder that it is the most tested of all forms of metal. The ease of calculation of cross sectional area of the metal under test, the fact that an unlimited number of test pieces are to hand, combine to make for frequent, rapid or accurate testing, and incidently make for a product which is not only of perfect quality but which can be produced with a minimum loss due to scrap, since it can be checked at various stages of its manufacture with the loss of only a few ounces of the material. Then taking into consideration that the tensile strength in steel wire alone varies from 22 tons per square inch to 180 tons per square inch, it is necessary that a great deal of testing be done, as in a wire mill, all the different grades are continuously in operation.

Not only is testing necessary to assure the quality of the final product but it also serves as a check on both the chemical composition of the raw material and its physical condition, which latter is due to the many and varied heat treatments through which it goes before being considered finished.

Then again, though wire may be subjected to all the tests applied to other forms of metal, it has several tests that are peculiar to itself. These tests are solely due to its shape and to that combination of properties which is summed up in the word "wire."

In the following pages it is proposed to give an outline of these tests and their meaning and to describe the apparatus that is most commonly used to perform them.

There is no doubt that the most important test to which wire is subjected, is the tensile test, and very few, if any, specifications for wire are issued which do not stipulate this test. As the breaking loads of wire vary from 10 tons on section of a stout wire down to a few pounds on section of a thin wire, it will be seen that it is necessary for a manufacturer who is making various grades and sizes of wire to have a range of tensile testing machines. An accurate test on a wire which had a breaking load of say 20 lbs. could hardly be expected when tested on a machine of 30,000 lbs. capacity, so a manufacturer cannot purchase one machine and do all the necessary testing on that one machine. It will be necessary for him to use a machine which will cover all the breaking loads of all grades of wire over a range of sizes covered by a group of consecutive numbers of the Standard Wire Gauge. Machines of the following capacities are suggested as a bare

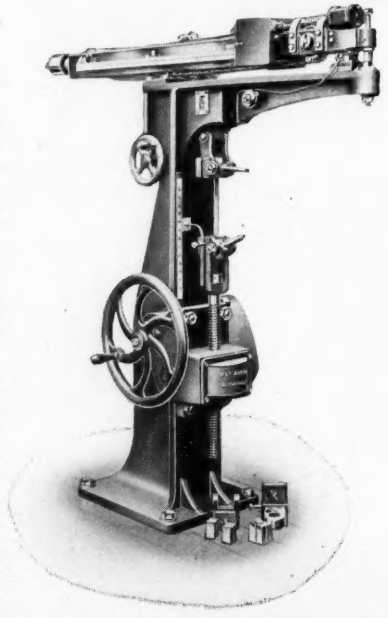


Fig. 2—A 6,000 lb. English testing machine. Power is applied through a screw by means of a hand wheel. Readings range from 20 to 6,000 pounds, with a vernier reading to 1 pound. There are two different loading speeds.

minimum though others could be added with advantage:

Capacity	Sizes Covered
30,000 lbs	7/0 G to 1 G
10,000 "	1 G to 8 G
6,000 "	8 G to 14 G
1,000 "	14 G to 19 G
200 "	19 C to 25 C

Machines that might be added with advantage are, of course, suggested with a view to extra accuracy and would comprise a robust dead-weight machine of 100 lbs. capacity and one of 15,000 lbs. capacity. The 6,000 lb. and 1,000 lb. machines might be replaced by two dual machines of 10,000 lbs. capacity having a smaller counterpoise by use of which the capacity is reduced to 1,000 lbs. With the substitution of these two machines the 10,000 lb. machine could be replaced by a 15,000 lb. machine and the range of breaking stresses better covered without an additional machine.

There are a great number of machines on the market for testing the tensile strength of wire. These fall roughly into four groups, viz., single or multilever, and horizontal or vertical of each type. They will also differ slightly in the method in which the load is applied. In the main, for those sizes of wire covering gauges No. 5 to No. 30, the load is applied by hand. In the thicker sizes the load is applied either by belts through gearing or by hydraulic power. The illustrations of machines in general are put forward more with the object of showing the diversity of construction than for recommending what should be used for each class or size of wire.

Testing Machines usually consist of four parts:—

(1) A steel yard or beam for counterpoising the load operated through a single lever or system of levers.
(2) Apparatus to apply the load.
(3) A device for gripping the specimen.
(4) A suitable housing for parts 1, 2 & 3.

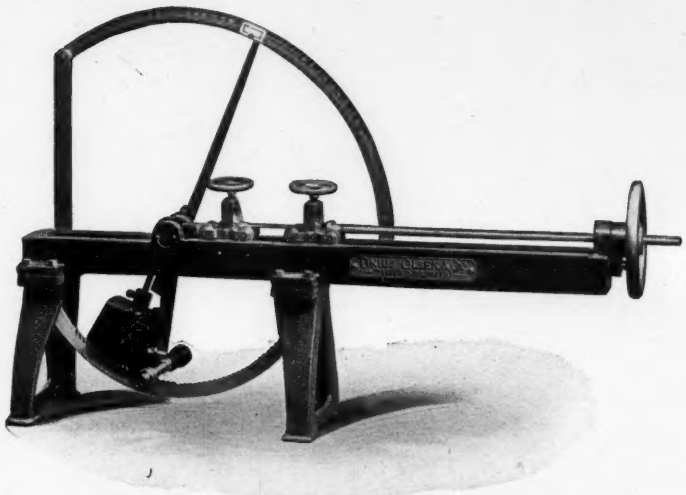


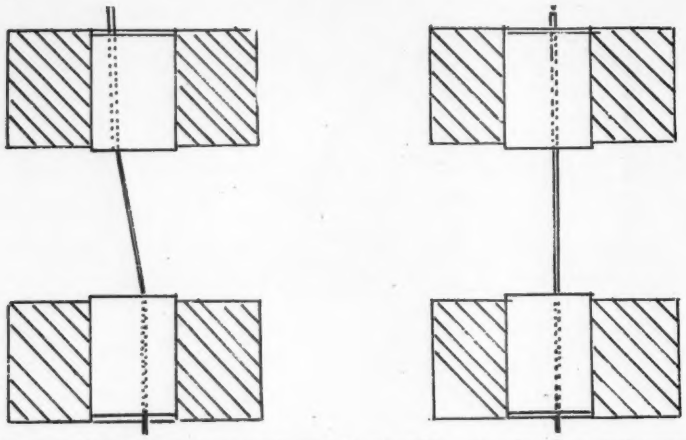
Fig. 3—An American testing machine of the delicate 200 lb. class.

These parts are differently arranged in the various machines illustrated according as they fall in one of the four types previously mentioned. Those machines in which the load is applied hydraulically are more often than not horizontal in type, and those that are gear driven will be vertical. There is another type of testing machine in which the actual load is recorded in pounds on a diaphragm by means of fluid pressure. The majority of machines for the testing of steel wire are of the lever type. Most of the machines manufactured in this country favor the single lever type, whereas American practice is solid for the multi-lever machine. Both types have their advantages, but there is no doubt that for wire testing the multi-lever machine is far steadier and just as accurate.

Fig. 4—A 200 lb. testing machine of English make is of the single lever variety on a very small scale. The poise weight carries a vernier.

Fig. 1 is an illustration of a wire testing machine for heavy duty. This machine, which is of American construction, consists of a large upper grip housing which is bolted to a steel table. The grip itself is mounted in a steel casting which can slide in the housing so that three different lengths of test pieces can be accomodated. The whole rests on four knife edges of two separate levers which are so arranged as to operate from one fulcrum. The long arm extends to the right and engages with a link which operates another lever again at a mechanical disadvantage running in the reverse direction. The end of this lever is linked to and operates the main beam, which carries the jockey weight for counter poising the load. The bottom grip is mounted on a steel plate and is raised and lowered by four worm screws actuated by bevel wheels and spur wheels. The rate at which this plate can be moved may be varied by means of a combination of spur wheels which are either directly driven by an electric motor or by a belt from a motor.

When a test is in progress a specimen is held firmly in each grip and the bottom grip lowered gradually. The specimen tends to transmit this motion



It is important that the pull be as nearly straight as possible. The wire at the right is properly adjusted in the grips. The one at the left will not test satisfactorily.

to the upper grip and in so doing causes the housing and table to press on the levers, which in turn raise the beam. The actual movement of the table is microscopical compared with two inches or so that the end of the beam moves through, so that, if the beam is kept floating, the position of the table is fixed and the test piece elongates until fracture occurs.

The grips of this machine consist of two pairs of wedges, which slide easily in slots and can be moved into position by two small hand levers. The ease and speed with which a specimen can be placed in the machine and securely gripped make it a very good one for wire testing. When it is taken into consideration that wire as a rule consists of 80 lb. coils and that each coil has to be tested at both point and back ends, it can easily be seen that a considerable number of tests must be carried out per ton of wire and that the rapidity with which this can be done is a great help in the output of a wire mill.

Another type of machine of 30,000 lbs. capacity is of English manufacture and while taking up more space, is a very convenient machine to handle and differs from the other machine in that the load is applied in a horizontal direction and then hydraulically. The right half of the machine houses the stationary grip, the levers, the motive power and the beam. The "fixed" grip housing floats on four knife edges suspended from four uprights by means of links. Motion is transmitted to the beam through a toggle lever, which is capable of imparting a large force with very little movement. The left half of the machine accommodates the moving grip and an hydraulic ram. Situated under the levers is an electric motor directly coupled to a rotary oil pump. Oil can be transmitted from this pump either to the front or back of a piston which moves in the big cylinder situated at the left hand end of the machine. By means of a half turn of the pump hand wheel, either to the left or to the right, the pump sets up a pressure of about 3,000 lbs. per square inch. Movement to the right causes the piston and the grip to recede, movement to the left is the return motion. This machine is convenient in that it is hand high and every part is accessible. Its best use, however, is the testing of small cables and thick rods where only a breaking stress is required. It is even more rapid for continuous testing than the upright model, as the speed of testing can be instantly varied by a very small movement of the hand-wheel, and also the return motion is exceptionally rapid.

10,000 lbs. Capacity

A machine of 10,000 pounds capacity is similar to that described of 30,000 lbs. capacity. The power is applied by gear and crank, having either slow or fast motion, thus providing a means for even application of the load. The load is weighed on a Dial Vernier Screw Beam, having two poises, one reading to full capacity and the other for light wire tests to one tenth capacity. The cross heads are provided with lever operated wages and the upper cross head is open for facilitating placing of the wire in the grips. This machine, which is manufactured in the United States, is undoubtedly the best machine for wire testing of its capacity.

6,000 lbs. Capacity

Fig. 2 shows a machine of 6,000 lbs. capacity constructed in England. This machine has several features which make it excellent for laboratory purposes. It is a single lever machine and the beam is calibrated in divisions of 20 lbs. to 6,000 lbs. with a vernier reading to 1 lb. There is also a scale and vernier to read the elongation of the specimen under test, although this is not a very desirable practice. Owing to the slipping of the wire in the grips during the early stages of the test the elongation would appear larger than is actually the case. The power is applied through a screw by means of a hand wheel and there are two different speeds of loading. The jockey weight has the additional feature of being automatically propelled by a falling weight through clean gearing. When the beam falls the jockey weight is automatically stopped by an electric brake, which is not released until sufficient load has been applied to the specimen to raise the beam again, ensuring that the specimen has not been overloaded, as might be the case had it been done by hand.

This machine, while being good and accurate, is of necessity on the slow side, making it more a research machine than a duty machine. The grips are narrow compared with other machines of similar capacity.

(*Please turn to page 241*)

Springs From the Designer's Point of View

Prejudice and lack of reliable data on performance records hinder the wider application of coil springs

By *Henry Barnes*
Designing Engineer

WHENEVER we see one of the great machines of industry we may be sure that somewhere hidden from sight is a coil spring of some kind constantly at work,

Of inconsequential appearance, sometimes actually out of sight, there is nothing exciting nor sensational about watching a spring at any time. Sometimes its performance is not even evident. This may partly account for the lack of appreciation of spring possibilities on the part of designers. In regard to many engineering problems of design it is possible to get away with a "high-hat" attitude without serious consequences or any evidence of error, but when it comes to springs the "high-hat" comes off. This may account for the stand often expressed,—"We will not use springs". It is possible that one of our most wonderful mechanical principles is not better appreciated because there have been so many burnt fingers in design, application and analysis.

Our competent predecessors have concentrated on the problems involved—torsion, tension, elasticity, manufacturing, tempering, etc.,—and presented their work to the world. In spite of this, however, there are many engineers and designers who, needlessly, will do anything to avoid the use of springs in a new design. The market for springs is tremendously large, the field of application being beyond conception.

The reliability of properly designed and heat-treated springs is established in a variety of materials. In spite of this fact the fixed policy of the engineering departments of some concerns is: "Don't use springs if there is any way around it." It may even be "taboo" in the Instruction Book handed to their designers and draughtsmen representing the attitude of the whole Company. As a result there exists a fallacy regarding the use of springs which has reached the point where they are strictly taboo with many designers.

Spring Reliability Proved

Of course, one thing contributing to this common fallacy is the fact that spring performance is not referred back to the designer. He knows very little of what kind of a spring was delivered to his specification. He knows little of how close it comes to performing the designed duty when new or in later years. He, therefore, is not in a position to accumulate an education regarding this particular mechanical principle which would allow him to gain the correct feeling of confidence and certainty with which to approach a new design of spring.

So therefore, if we can prove the reliability of properly designed springs, we may remove the taboo phase of the subject, and in time we will have eliminated that rigidity of mind which prevents the proper understanding as to application and design mathematics.

What we want is relaxed mental effort in regard to springs in order to completely cover the field of spring application. It should not be a specialty on the part of a comparative few who, if they could, would control the information or surround it with mystery. That few would be more benefitted financially if springs were not so hard to digest by the many who could use them.

One realizes that the aforesaid fallacy is common and of great extent when confronted with advertising matter in an important engineering journal appealing to the taboo field with: "No springs or other delicate mechanisms." There are but few cases in which that sort of statement is really justified by a better mechanism. The manufacturers of one very well known apparatus state in their catalogue sent out with each article sold: "and to insure reliability of operation a governor with a *weighted lever* is to be preferred to the *spring type*."

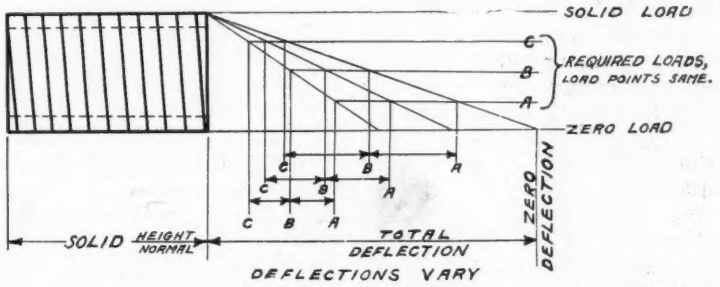


Chart No. 1. To design and calibrate a spring to any number of given loads coinciding with an equal number of given heights.

There are a good many who seriously take exception to such a statement. We do know that some governors have improper springs mounted on them, some even being of the wrong type. That has no bearing on the question of *reliability* of springs.

New Data for Designers

The prospective user of springs is dependent on the designing engineer or draughtsman, also, to a great extent, the manufacturer of springs. Heretofore there has been a lack of information for the designer as to formula for Lead, Deflection, Set, Lead after set, etc., with little information as to Material, what stresses to use consistent with Lead, what long-life factor, etc. It has not been difficult to assemble a profusion of information on the above, a little here and a little there, not coordinated, not usable in simple form, also with a great difference in arrangement of tables (called charts) resulting in confusion when attempting to design a spring. Some prominent tables are erroneous with respect to desirable proportions and misleading by such inference, compelling many of us to assemble a mass of more trustworthy data and to work out reliable tables of our own.

For thousands upon thousands of applications there need be but an approximately designed spring—without calibration of Lead at certain heights—just so long as the spring is surely *safely* designed and applied. The long-life factor should not be based on Breaking Point nor Ultimate Strength, (although if based on Breaking Point a better spring would be the result if the factor brought working stress within the Elastic range), but based on Yield Point, or better still and more correctly, on the Elastic Limit. Getting the strength of spring steel corresponding to the Elastic Limit is part of the difficulty facing the designer. The term Factor of Safety should be discontinued, as it is only a brittle spring that is not safe in use so far as breakage is concerned. Brittleness does not come within the designer's control nor the province of proportions.

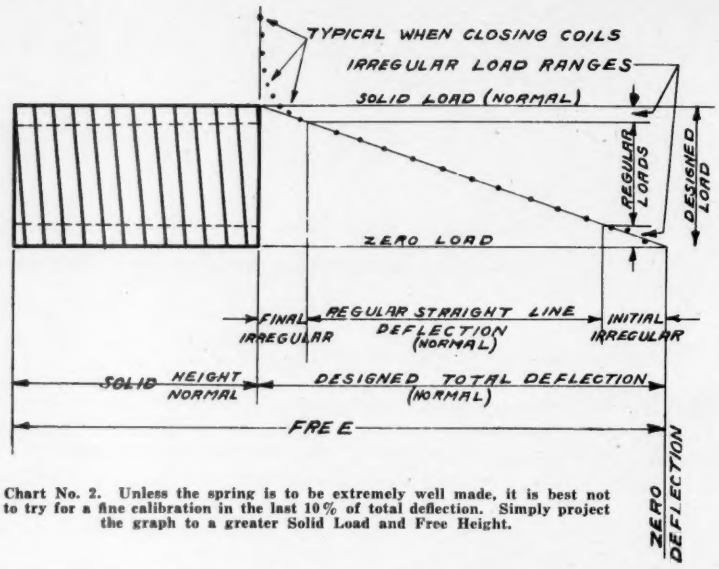


Chart No. 2. Unless the spring is to be extremely well made, it is best not to try for a fine calibration in the last 10% of total deflection. Simply project the graph to a greater Solid Load and Free Height.

Spring DUTY or RESILIENTS, (to use the term of Mr. Joseph Kaye Wood), is a matter for special study and most difficult to master. Resilients may be resolved from the angle of horse-power or foot-pounds of energy the spring may safely absorb, and also understood as Duty performed. Springs may very properly be classified as to Duty with reference to "long-life factor" according to the following:

This factor applies to the load required to compress the spring solid. The initial load under installation will be considerably less than that. The small margin of factor 1.111 should only be used where all information is absolutely reliable and manufacture well controlled.

For these Heavy Duty springs comparatively seldom required in engineering practice one need better go slowly and carefully, consulting the very best authority available on Material and Proportions, as well as the prospective maker of the spring. And of course, to the degree of exactness required in the application of all lesser Duties, must be applied a corresponding degree of exactness of design knowledge. By Heavy Duty spring there is not necessarily inferred a large spring of wide open coils, (although that is the usual mental picture associated with the term),—but the spring that has many changes in stress taking place rapidly, perhaps under conditions of installation which subject it to constant vibration foreign to the designed duty, therefore requiring a greater long-life factor than usual. Part of the answer to such a condition is to use as large a wire as possible, with a proper ratio of D/d, (not less than 5). In other words, pick a large, strong man for an ordinary amount of work that has to be done constantly, don't tire him out. A Heavy Duty spring may be but a very small 1/32" wire and correspondingly short, (preferably up to 3 times its diameter in length), or it may be a huge compact looking

(*Please turn to page 244*)

Duty	Condition of Leading	Long-life Factor
Very Light	Static	Elastic Limit X .90=f 1.111
Light Duty	No Vibration	Elastic Limit X .80=f 1.250
Medium Duty	Some Vibration	Elastic Limit X .60=f 1.667
Heavy Duty	Medium Vibration	Elastic Limit X .40=f 2.5
Extra Heavy	Constant Vibration	Elastic Limit X .20=f 5.0

The Theory and Practice of Pickling

The properties of acid solutions of various strengths, effects of temperature control, and the uses of inhibitors

THE pickling process consists of treating metals with dilute acid solutions, with the object of removing scale and rust.

Kinds of Scale

Scales for the most part are iron oxides and an investigator of their properties puts them into the following classifications:

1. Hydrated ferric oxide, which may be represented by the formula $Fe_2O_3x\ H_2O$. This is ordinary brown rust and is soluble in dilute pickling acid.

2. Anhydrous ferric oxide (Fe_2O_3) is similar to brown rust but is formed in the absence of water. It is the well-known blue scale and is somewhat soluble in pickling acids.

3. Magnetic oxide (Fe_3O_4) is the black scale which is formed in hot working operation. This scale is very slightly soluble in acids.

Scales which must be removed by pickling consist chiefly of the two last mentioned oxides. From the characteristics of these oxides it follows that they are not removed by dissolving action on the scale itself. The action is largely mechanical. The acid penetrates the scale and dissolves a thin layer of metal. This is accompanied by the evolution of hydrogen. The scale is forced off and falls to the bottom of the tank.

Kinds of Acid

Sulphuric Acid is in most general use for pickling, due chiefly to its low cost. Concentrations of the pickling solutions vary from 2 to 15% acid. The rate of pickling with Sulphuric Acid is slow and the action on the metal is irregular, with the result that pitting is frequently encountered.

FOR this brief but comprehensive outline of the processes involved in treating metals for the removal of scale and rust we are indebted to the Weaver Brothers Company of Clinton, Michigan. The accompanying article is taken, with their permission, from a booklet they have issued on pickling equipment and metal cleaning supplies.

The bath must be heated in order that a fairly rapid rate of pickling may be maintained. The acid bearing fumes from the hot bath are disagreeable for the workmen.

Muriatic Acid is used in strengths of 10 to 50% commercial acid. The pickling action of Muriatic Acid is more rapid. The metal itself is not so strongly attacked so that the danger of pitting is not so great. Muriatic baths are operated at lower temperatures without the generation of steam. Consequently the fumes are not as troublesome as in the case of sulphuric Acid. The chief objection to the use of Muriatic Acid is its high cost as compared to Sulphuric.

Acid Strength and Temperature

Acid Strength and Temperature should be considered together, for both of these factors affect the rate of pickling. Pickling may be speeded up by increasing the acid content up to about 20% actual acid. Beyond this point an increase in acid slows down pickling. In actual practice the acid strength is varied between 2 to 15%.

Changes in temperature have a greater influence on rate of pickling than do variations in acid strength. An increase of 20 degrees F. will double the rate of pickling. The range of temperatures for most pickling operations is between 140 degrees F. and 180 degrees F.

The matters of acid content and temperature are largely dependent upon individual plant conditions and tank capacities. Acid strength of 5% and temperatures between 140 and 160 degrees are advisable in most cases, giving as they do, a minimum of fumes and the best working conditions. Stronger solutions and higher temperatures will increase production but the added tonnage will be attended by greatly increased volume of fumes, together with the danger of over-pickling, pitting and acid-brittleness.

Pitting

Acid does not attack the steel uniformly, due to the crystalline structure of the metal and non-metallic inclusions. Since some of the crystals are more soluble than others, the action of the acid roughens the surface of the metal. This roughening effect increases as the acid action is allowed to proceed. Thus the result of prolonged attack is a badly pitted surface.

Acid Brittleness

Acid brittleness is known to be due to the absorption of hydrogen, which is always formed when acid acts on iron. The conditions which favor the absorption of hydrogen are high temperature, dilute solutions and long pickling time. A strong acid solution, temperature of not over 150 degrees F., and the shortest possible pickling time are precautions to be observed to avoid acid brittleness. Since acid brittleness is due to absorbed hydrogen it follows that any factor which prevents or reduces the formation of hydrogen will have a favorable action. Inhibitors, which will be discussed later, have an important bearing on acid-brittleness.

Black Coating on Steel

Steel, of course, consists of iron and carbon. Acid dissolves the metal but has no action on the carbon. Thus when the metal is removed, a black deposit of carbon remains. A visible black coating indicates that the steel has been pickled too long.

Pickling High Carbon Steels

High carbon steel is attacked much more rapidly than ordinary low carbon steels. For this reason it has always been considered difficult to pickle. High carbon steel requires a sharp, quick pickle. The quicker the scale is removed, the less steel will be dissolved.

Alloy Steels

Alloy steels are attacked very rapidly, due to the presence of a large number of minute electrolytic couples which are set up between the steel and the alloying elements. This unusual attack results in a roughened or blackened surface unless great care is taken in pickling.

Inhibitors

Many of the difficulties which attend the pickling of iron and steel may be lessened or entirely eliminated by the addition of an "inhibitor" to the pickling bath. Inhibitors for the most part are colloid chemicals of organic origin which have a peculiar influence on the pickling action. It has been claimed for some inhibitors that they reverse the process of pickling as described earlier in this discussion, causing the acid to dissolve the scale and have no action whatever on the metal. These strong claims are not strictly true. There must be some solution of metal and formation of hydrogen for the scale to be removed with any degree of speed. The real function of the inhibitor is more complex. When an inhibiting compound is present in the pickling solution it is deposited on the surface of the metal parts being pickled.

Without discussing the theories of electrolytic solution tension which are involved, we can say that the inhibiting compound is deposited most heavily where the tendency toward solution is strongest. Thus the deposit is heavy on the clean metal surface, around slag inclusions and other irregularities and much less heavy on parts still coated with scale. These colloidal deposits retard solution, so that the result of this unequal coating is that solution is slowed down where it is not needed and is permitted to take place rapidly where it is needed. In this manner, excessive solution of metal is prevented and the volume of hydrogen generated is very limited.

The many advantages that accompany the use of an effective inhibitor must be apparent from the foregoing discussion. Sulphuric Acid may be used at higher temperatures and in stronger solutions with a tremendous increase in production. This added production, however, is not attended by the difficulties that would otherwise present themselves. There will be no troublesome fumes, since the hydrogen generation is very small.

The amount of metal which goes into solution will be reduced to a slight amount so that the possibility of overpickling and pitting is reduced to the vanishing point.

Acid brittleness and blistering of sheets, being caused by hydrogen, can be controlled.

Black deposits will be eliminated and high carbon and alloy steels can be properly pickled without the difficulties which usually are a part of this process. In all cases, the use of an inhibitor results in a large saving in acid.

Formation of Iron Salts

The activity of a Sulphuric Acid pickling bath gradually slows down, due to the presence of dissolved iron. This effect is not particularly noticeable until the concentration reaches about 8% iron. This percent is equivalent to 40% iron sulphate or copperas. Pickling, though slowed down, can be carried on until iron sulphate starts to crystallize out and attach itself to the bottom and sides of the tank and to the work. It has been found that crystallization starts at ordinary pickling temperatures, when the dissolved iron content reaches about 10%.

It is usual practice to dump the tank before crystallization starts. It is obvious that some acid is poured out with the discharged liquor. This wastage can be reduced to a minimum by the following practice. When the iron content reached a predetermined figure, say 8%, add no more acid to the tank but increase the temperature and finally dump when the solution is no longer sufficiently active at the highest working temperature.

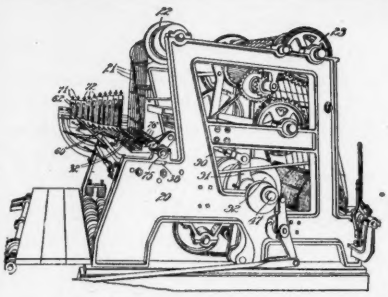
The accompanying table shows the percent waste of total acid used when the discharged liquor contains given amounts of free acid and dissolved iron.

PERCENT SULPHURIC ACID WASTED IN DISCHARGED LIQUOR

Percent Acid	Percent Iron									
	1	2	3	4	5	6	7	8	9	10
1	36	22	16	12	10	9	8	7	6	5
2	53	36	28	22	19	16	14	12	11	10
3	63	46	36	30	26	22	20	18	16	15
4	70	53	43	36	31	28	25	22	20	19
5	74	59	49	42	36	32	28	26	24	22
6	77	63	53	46	41	36	33	30	28	20
7		67	57	50	44	40	36	33	31	29
8			60	53	48	43	40	36	34	31
9				56	51	46	42	39	36	34
10					53	49	45	42	39	36
11					55	51	47	44	41	39
12						53	49	46	43	41
13							51	48	45	43
14								50	47	45

Table showing the per cent. waste of total acid used when the discharged liquor contains given amounts of free acid and dissolved iron.

A REVIEW OF RECENT PATENTS



Wire Fence Machine 1,670,172

Detailed technical descriptions are given only for the devices illustrated. All other descriptions of patents listed on this page have been abstracted from official records.

1,670,172. WIRE-FENCE MACHINE. Lafe Swank, Anderson, Ind. Assignor to Dwiggins Wire Fence Company, Anderson, Ind. In a machine for producing wire fabric, the combination with means for supporting and forwarding a series of running wires, a series of stay-wire twister heads through each of which a running wire passes, means for intermittently rotating the said twister heads, and means for associating stay wires with the running wires through the medium of the twister heads, said means comprising, for each pair of running wires, a two-part holder arranged between said pair of running wires and formed to receive, guide and support a stay wire, a series of stay wire guides each leading to a holder but spaced therefrom by a twister head, a series of stay-wire cutters, one adjacent each twister head and arranged to cut a portion of a stay wire from its supply, and means for intermittently actuating said stay-wire cutters.

1,670,006. WIREWORKING MACHINE. Hans Prym, Stolberg, Germany. In a device for clamping and feeding wires in wire-working machines, a slidable carriage for feeding the wire, a driven shaft, a cam disk on said shaft, a double lever moved by said cam disk and reciprocating said carriage, separate wire clamping means in said carriage and separate means mounted directly on the double lever for actuating said clamping means.

1,669,096. CLINCHING TOOL FOR WIRE CLIPS. Ralph L. Madsen, Persia, Iowa. The pivoted jaws have wire receiving grooves, one jaw being longer than the other and with its free end formed with a wire receiving opening communicating with the groove.

1,669,743. METHOD OF MAKING WIRE. Flint C. Elder, Mount Lebanon, Penn. Comprising a pair of parallel tapered stretching rolls arranged to thread a work piece from the small end of one roll to the large end of the other while drawing the work piece endwise so as to rotate the rolls and stretch the work piece lying between them.

1,669,211. REENFORCING MEANS FOR WOVEN WIRE PANELS. John R. Scherer, Detroit, Mich. Assignor to the Abbey-Scherer Company. Panel has binding strips at side edges comprising a tie-bar and spreader-bar.

1,669,660. WELDING ROD. J. Birchard Green. Assignor to Chicago Steel & Wire Co., Chicago, Ill. A process of coating welding rods which comprises dipping the rods in a bath containing a binder and about 325 parts of calcium carbonate to every 500 parts of water.

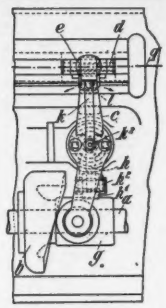
1,669,678. WIRE TIGHTENER AND STRETCHER. Fred W. Simmons, Grand Island, Nebraska. A rotating length of pipe, with passages through which strands of wire may be passed, provided with a lever to take up the slack in the wire and hold it while the free end is formed into an eye.

1,669,817. WIRE TIGHTENING MACHINE. John A. Gilman, Seattle, Wash. A wire working tool comprising rotating wire gripping elements whereby to twist the wires, and means for equalizing the tension.

1,669,833. MACHINE FOR AND METHOD OF MAKING CAN-OPENING KEYS AND ATTACHING THE SAME. A machine for forming an article from a moving piece of metal and uniting the formed article with a body on which it is to be used, impressing the metal and cutting it into lengths while moving, and means for forming the impressed metal into the finished article.

1,670,044. TIRE BEAD CONSTRUCTION. Robert C. Pierce, Akron, Ohio. Assignor by mesne assignments to American Chain Co., New York. A tire bead construction provided with a relatively inextensible metallic reinforcement of longitudinal wires, each wire except the marginal ones being interlaced with two adjacent wires only.

1,670,045. METHOD OF WEAVING WIRE TAPE FOR TIRE BEADS. Robert C. Pierce, Belleville, N. J. Assignor by mesne assignments to American Chain Co., New York. A method of forming wire tape for making grommets by weaving a weft wire to embrace a series of warp wires and directing the path of the weft wire at intervals determined by the circumference of the grommets to embrace a different number of warp wires.



Wire Working Machine 1,670,006

1,670,198. APPARATUS FOR FORMING AND SECURING WIRE HINGES IN METAL BOXES AND BOX PARTS. W. G. Huxtable and R. E. Gold, Swansea, Wales. A hinging machine for metal boxes combining means for feeding wire, determining its correct length, holding and forming the wire.

1,670,528. ANTISKID CHAIN. Forrest C. Carpenter, Chicago, Ill. Means for connecting the adjacent ends of cross chains in an anti-skid device employing rings with lugs.

1,670,543. CABLE GRIP. Edgar E. Kellems, Syracuse, N. Y. Interlaced wire strands form a series of loops in uniformly spaced relation and extend continuously from the draft end of the grip to the cable receiving end.

1,670,993. APPARATUS FOR LAYING OR GUIDING ROPES, CHAINS, AND CABLES. W. S. Smith, Benchams, Newton Poppleford, and Alfred D. Shuter, Harrow-on-the-Hill, England. An apparatus for guiding a continuously flexible member on and off a drum provided with a loosely mounted ring and means for preventing lateral movement of the ring along the drum in a direction away from the flexible member.

1,671,417. WELDING ROD. Russell Franks, Elmhurst, N. Y. Assignor to Oxweld Acetylene Company, West Virginia. A Welding rod composed of alloy containing tungsten 1% to 12%, chromium 25% to 35%, boron 0.10% to 1.0%, carbon 1.0% to 3.5%, silicon at least 0.50% and not over 3.0%, and manganese in sufficient quantity to deoxidize the alloy, the ratio of silicon to manganese being at least 0.9.

1,671,456. WIRE TYING DEVICE. Roy S. Thompson, Bay Village, Ohio. A tool for feeding a length of wire longitudinally, bending it partially around the object as it is fed forward, and for severing and twisting the ends of the wire.

NEWS OF THE INDUSTRY

Farmers Buying More Fence

An annual increase of 10% to 15% in fence purchased by the American farmer will be seen each year for the next five years, B. L. Sommer, president of the Keystone Steel & Wire Co., predicts. In 1927, he says, total sales increased more than 20% over the previous year as a result of changing conditions in the industry and general improvement in the agricultural situation. Indications are last year's totals will be surpassed in 1928.

"Following the World War," says Mr. Sommer, "straitened circumstances caused the farmer to patch up his fences as best he could and get along without buying new wire. This was continued until it became necessary to make large replacements. At the same time the extension of diversification and dairying brought more need for good fences."

Foreign Trade

FOREIGN trade opportunities reported by the U. S. Bureau of Foreign and Domestic Commerce during the month of June include inquiries from the following sources: For wiring supplies and fixtures (31565) from Warsaw, Poland; for barbed wire (31616) from Bogata, Colombia; for enameled magnet wire (31671) from Toronto, Canada; for a thousand pounds of steel wool (31701) from Swatow, China; for insulated wire and cable (31758) from Johannesburg, South Africa; for bolts, nuts and wire nails (31781) from Ponce, P. R.; for wire nails (31788) from Penang, Straits Settlements; for brass, copper and bronze rods, wire, rivets, nails, tacks, etc., from Nantes, France (31790); for wire springs winding machines and machines for making helicals, from Mexico (31959).

By a decree promulgated in the official Costa Rican gazette of April 14, the exemption of machinery from import duties when imported for industries not yet established in Costa Rica has been extended for a further period of 10 years.

Wickwire Spencer Progress

COMMITTEES representing bond and note holders of the Wickwire Spencer Steel Company have made satisfactory progress for evolving a plan for readjustment of the company's complex capital structure, according to a special report in the New York Evening Post. It is understood that more than half of the outstanding first mortgage 7s and Class A notes and in excess of 90% of the B notes have been deposited. Despite unfavorable market influences, the company has averaged something more than $900,000 a year net after depreciation. The company's cash position has considerably improved as a result of conservation of cash under the receivership and in the last three years a capable management has emerged from the situation. For this reason cooperation among the important interests represented is anticipated and it is expected that the bankers will do a thorough job of placing the company in a position to meet competition.

Personal

FOR the first time in many years, James A. Farrell, President of the United States Steel Corporation, recently visited the wire drawing plant in New Haven, Conn., where he began his industrial career as a wire puller at the age of sixteen. The plant, now the American Steel and Wire Company, was formerly the New Haven Wire Company and is located in the city of Mr. Farrell's birth. His youthful transfer from school to factory followed the loss of his father at sea and was made at a time when workmen in the industry drew a weekly pay envelope of $4.65 for a twelve-hour day.

William H. Balke, retiring production manager of the Acme Wire Company, New Haven, Conn., was tendered a farewell banquet by about fifty officers and executives of the company in testimony of their high regard for his services, which extended over a score of years. Mr. Balke's former associates presented him with a handsome humidor.

New Electric Standards

ADOPTION of minimum standards of performance for electrical products as the next logical step in the standardization program of the electrical industry was recommended by W. S. Rugg of Westinghouse Electric and Manufacturing Company to the second general session of the policies division meeting, National Electrical Manufacturers Association.

Successful standardization already accomplished by the industry on apparatus characteristics, such as capacity, speeds and dimensions, should be followed by establishment of quality levels of performance, in Mr. Rugg's opinion.

Regarding the minimum standard of performance as a direct means of production, and above all, of insuring the user of apparatus against unbalanced design and performance, and general unsatisfactory service, Mr. Rugg described the ideal minimum standard as accomplishing a balance between:

1. Lowest cost of manufacturing and distribution.
2. Greatest adaptability to the purpose for which the apparatus is to be used.
3. Greatest durability, or its length of life.

4. Lowest cost of maintenance.
5. Lowest cost of power for operating it.

THE two remaining submarine cables connecting Manhattan and Brooklyn are destined to go as the result of the installation of five new telephone cables, containing 2,000 trunk circuits, in the Clark Street tunnel. There are now forty five cables in service in the tunnels connecting the two boroughs.

British Wire Rope Manufacturers Organize

THE prime importance of maintaining a high standard of quality in wire ropes, especially for use in mines, has recently been the subject of a report published by the Safety in Mines Research Board. An important step in connection with the use of wire ropes in Britain has recently been taken in the formation of the Federation of Wire Rope Manufacturers of Great Britain. As yet not much is known of this body and it has not yet issued any definite platform or program. According to E. J. W. Buckpitt, secretary of the Federation, plans are at present in embryo, but it has the support of the leading British manufacturers of wire rope. While its first aim will be to maintain quality, it is quite clear that, like other producers' organizations, it will also keep one eye on prices. It is explained that keen competition has forced the prices so low that it is unprofitable to produce wire ropes of the best quality under existing conditions. It is hoped that the Federation will succeed in keeping quality up by educating the consuming public to the merits of "buying the best." For this purpose a cooperative national advertising campaign will be embarked upon.

Secretary Buckpitt brings considerable experience to his new position, as he is also secretary of the Rope, Twine & Net Manufacturers' Association, a federation of the fiber rope producers' of Britain.

COMING EVENTS

August 27-30. American Society of Mechanical Engineers Summer Meeting at St. Paul and Minneapolis. Secretary, St. Paul Hotel.

Sept. 24-28. American Electric Railway Association at Cleveland. Secretary, J. W. Welsh, 292 Madison Avenue, N. Y. City.

Oct. 1-5. National Safety Council, National Congress, at New York. W. H. Cameron, Managing Director, 108 East Ohio St., Chicago.

Oct. 17-19. Society of Industrial Engineers at Rochester, N. Y. Secretary, 608 South Dearborn St., Chicago.

Oct. 2-5. National Association Ornamental Iron and Bronze Manufacturers at Boston. Secretary, C. F. Waltz, 622 Broadway, Cincinnati, Ohio.

Oct. 8-12. American Society for Steel Treating at Commercial Museum, Philadelphia, Secretary, W. H. Eisenman, 7016 Euclid Avenue, Cleveland, Ohio.

Oct. 16-18. American Railway Bridge and Building Association at Boston. Secretary, C. A. Lichty, 310 N. Waller Avenue, Chicago.

The Standing Committee on general merchandise appointed by the British Board of Trade will hold its inquiry at the end of July as to whether imported copper rods and wire (other than insulated wire) should bear an indication of origin. This inquiry will be held at the Board of Trade Offices in London, and it is thought likely that the Board's decision will be put into immediate effect.

Building and Expansion

The R. B. Hayward Company, Chicago, Illinois, have recently entered into an arrangement with Electrical Research Products, Inc., to manufacture under Western Electric Company patents a complete line of steel machine reels, steel drums for shipping reels, and all-steel shipping reels for wire and cable manufacturers.

General Cable Corporation has purchased a sixty-acre plant site at Mobile, Ala., for a new copper wire mill. Construction will begin at an early date. The location was chosen with a view to serving Southern utility companies.

Maring Wire Company, Anderson, Indiana, has been recently incorporated and will manufacture enamelled, cotton and silk covered wire and electrical apparatus.

Kenney Mfg. Co., Wellington Ave., Auburn, R. I., manufacturer of metal curtain rods, will build and equip an additional plant at an estimated cost of $50,000.

Northwestern Barb Wire Co., Sterling, Illinois, will rebuild the plant recently destroyed by fire. Cost of building and equipment is estimated at about $200,000.

American Copper Products Corporation, Bayway, Elizabeth, N. J., manufacturers of copper and brass wire specialties, is building and equiping a one-story factory addition at an estimated cost of $80,000.

Lynn Ornamental Iron Works, Lynn, Mass., contemplate building a one-story addition at a cost of about $20,000.

Racine Screw Works, Racine, Wisconsin, will build and equip a new plant to replace the one destroyed by fire a few months ago.

Ward Leonard Electric Company, South Street, Mt. Vernon, N. Y., manufacturers of electrical resistance products, are building and equipping a one-story addition at an estimated cost of $85,000.

A new factory unit for the production of lead cable is being built at Orange, California, by the California Wire and Cable Co. at an estimated expense of $75,000.

Seward Wire Co., Camden Avenue, Parkersburg, W. Va., is completing an addition which will about double the former floor space and be devoted to storage of finished wire. This is the third addition to the plant in the past three years.

Sleeper & Hartley
TRADE MARK

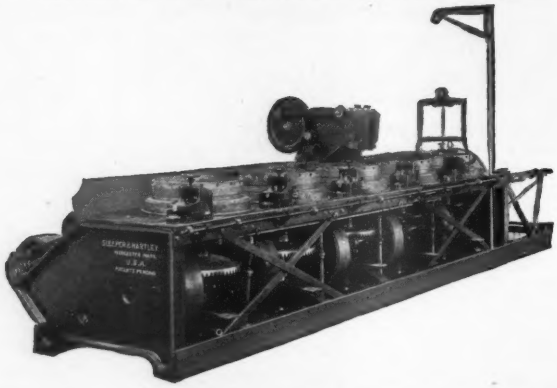
Practical Continuous We

These Machines Go Into Production at ...—Re

Rod Frame

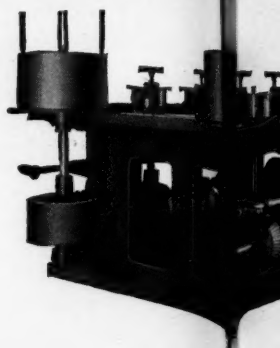
(No. 5—14 or 15 wire)
Patented June 3, 1924—May 12, 1925—others pending

All Ball or Roller Bearings
No Differential Gearing.
Automatic Compensation for Speeds of Heads.



Double 5-Draft..., In...

No. 14 to No. 23. ...r low
3 to 4 Blocks ...rage
No. 14 to 19—4 ...00 lbs
No. 14 to 20—5 ...00 lb
More than 250 heads of ...roved



Spring Coiling Machinery

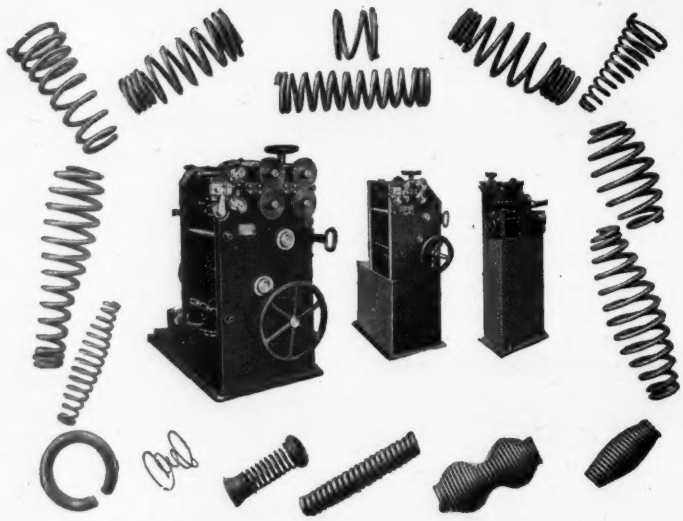
of every description

For example, we offer:

Universal Spring Coiling Machines

in ELEVEN Sizes

handling oil-tempered wire from .004" to ⅝" diam. These machines produce spring forms as illustrated herewith at very high productive speeds.



Patented

AGENTS: CHICAGO TERRITORY,
Neff, Kohlbusch & Bissell, Inc.

SLEEPER & ...A

FOREIGN AGENTS AND REPRESENTATIVES: UNITED KINGDOM—Mr. Fredk. A. Perry, 63 Queen Victoria St., London, E. C. 4.
FRANCE—Mr. Edgar Bloxham, 12 Rue du Delta, Paris. BELGIUM—Isbecque, Todd & Cie., 25-27 Boul. Emile ...E. C. 4.
Bockstael, Brussels.

WORCESTER, MA...

We Drawing Machinery

Sleeper & Hartley TRADE MARK

—Reducing Overhead-Increasing Production!!

...y, Intermediate

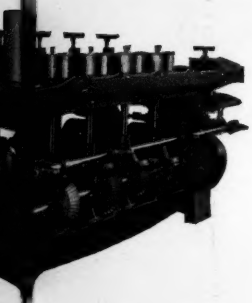
...r low carbon wire.

...rage Operator.

...00 lbs. per block.

...00 lbs. per block.

...roved model in operation

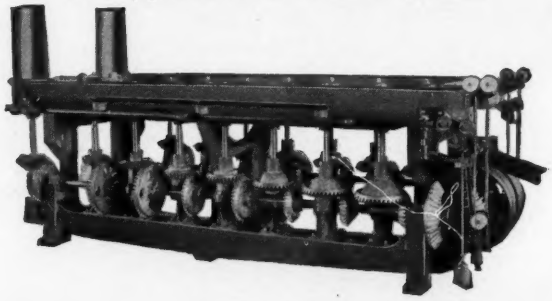


Double 8-Draft Fine Wire: Wet

No. 22 to 36. High or low carbon wire.

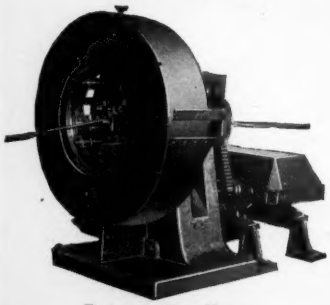
6 Blocks to Average Operator, 22-33, 8-hole, 660 lbs. per day of ten hours.

Many thousands of these heads in operation



ARMORING MACHINES FOR

"BX," PARK CABLE MOTOR WIRES, HOSE Etc., Etc.



Patents Pending

High Productive Speeds

LOCK WASHER MACHINERY

with Enormous Output

HIGH SPEED STRANDING MACHINERY

...ARTLEY, Inc.

Agents: Philadelphia Territory
Swind Machinery Co.

ITALY—Henry Coe & Clerici, Milan. AUSTRALIA AND NEW ZEALAND—Edwin Wood Pty., Ltd., Melbourne.
JAPAN—Andrews & George Co., Toyko. SWEDEN AND FINLAND—Akt., Maskinaktiebolaget Karlebo, Stockholm.

...MASS., U. S. A.

The Heat Treatment of Drawn Wire For Bridges

Better knowledge of high-strength steels points to prospect of longer and lighter bridges

By A. V. de Forest

Research Engineer, Page Steel & Wire Co.

Reprinted from Transactions of the American Society for Steel Treating.

Editorial Note: By way of prefacing Mr. de Forest's paper, the reader should understand that it was written as part of a symposium on the subject of bridge steels. Each of four contributors treated a separate phase of the subject, Mr. de Forest's assignment being drawn wire. His allusion to Mr. L. S. Moisseiff will be further explained by the following quotation from the latter's paper entitled "High Strength for Modern Bridges". Mr. Moisseiff, who is consulting engineer for the Port of New York Authority and designer of the Philadelphia-Camden bridge said, in part:

Early Use of Bridge Wire

"Since Messrs. White and Hazzard in this country in 1816 and Séguin Fréres in France in 1826 introduced drawn wire for bridge cables, wire in one form or another became important material for the builder of either light weight or long span bridges. With a very few exceptions suspension bridge cables have been built of wire. The available bridge wire has with time undergone many improvements and, it may well be stated here, has attained a high degree of perfection and strength. The improvement has been in the selection of the material and the process of manufacturing. It has been gradual. Since the wire used in the Brooklyn bridge till today the evolution has been in the direction of a higher elastic limit and a greater strength. No new methods or new alloys have been brought forward."

The growth in ultimate strength of wire used in the largest suspension bridges is shown in the table.

Specified Ultimate Strength of American Bridges

Bridge	Date	Lbs. per Sq. In
Brooklyn	1880	160,000
Williamsburg (N. Y.)	1900	200,000
Manhattan	1906	210,000
Delaware River	1923	215,000
Hudson River	1927	220,000

Only recently an improvement in wire making by means of heat treatment has been brought forward.

Metallurgists are better informed than bridge engineers as to characteristics of heat treatments and the possible advantages that may be obtained as well as to the possible dangers that may be incurred. Doubt has been expressed as to the effect of time on heat treated steel. The question has been raised whether the qualities acquired through the heat treatment will endure during the many years the member is expected to function. Naturally engineers are anxious for positive information. I believe it is up to the manufacturers to inaugurate exhaustive tests to settle the question."

Mr. de Forest's paper follows:

WIRE for suspension bridges has heretofore been manufactured under the same general conditions as high grade rope wire. Steel with a carbon content of about 0.80 per cent is hot-rolled into rods which are then given a particular heat treatment, termed patenting, (in reality a sorbitizing process) and then drawn cold through several dies of different diameters to the finished size.

In the form of patented rod, the wire will have a tensile strength of from 130,000 to 160,000 pounds per square inch. However, the ductility of this patented structure is greater than that of similar material annealed, which would have a much lower tensile strength. After drawing, the stress-strain characteristics of the wire are represented by the curve for bright wire in Fig. 1. At 0.70 per cent elongation the conventional yield point would be 142,000 pounds per square inch, but the breaking strength would be very high in comparison, perhaps reaching 275,000 pounds per square inch, with a total elongation of 1.5 per cent.

This hard drawn wire is then galvanized in order to protect the surface from corrosion. The mechanical properties are greatly affected by the heat treatment accompanying hot galvanizing. The structure is partially recrystallized, the tensile strength is lowered, the elongation is markedly increased and the yield point and modulus of elasticity are improved. Galvanized wire such as used for the Delaware River bridge is also shown in the figure and under good conditions would

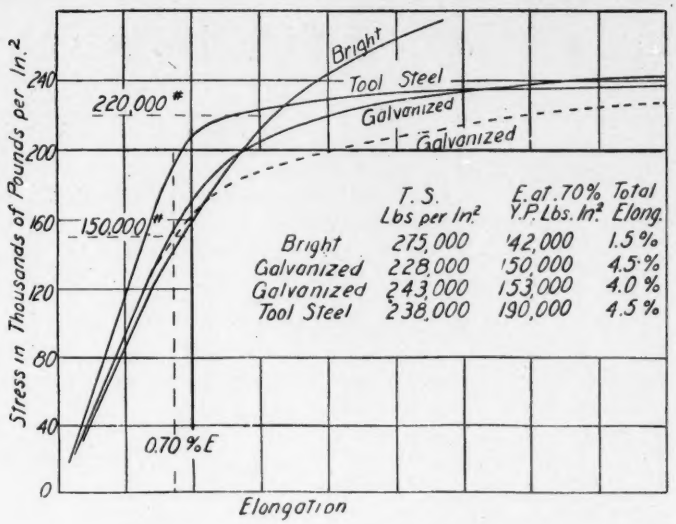


Diagram showing stress-strain characteristics of tool steel wire after drawing. The breaking strength is not particularly higher than that obtainable by cold working and galvanizing, but the yield point and modulus of elasticity are very markedly improved.

have a tensile strength of around 228,000 pounds per square inch with a yield point of 150,000 pounds per square inch and an elongation above 4.5 per cent.

For the Hudson River bridge, attempts were made to improve this product by further improving the strength of the hard drawn bright wire before galvanizing. The characteristics of this type of material are also given in the diagram as the upper curve labeled "galvanized". About the maximum limit is a breaking strength of 243,000 pounds per square inch with a yield point of 153,000 pounds per square inch and somewhat less elongation than at the lower figure. This increased strength is obtained at the expense of ductility as measured in other ways and the wire does not appear to be as reliable or generally satisfactory as the softer stock.

Use of Heat Treated Steel

Another system of wire making has been developed for bridge work which shows a marked improvement over the figures quoted above. In this case, instead of wire hardened by cold working, a fully heat treated steel was used in the quenched and tempered state. The characteristics of this are shown in the diagram under tool steel which to all intents and purposes this material actually is. The breaking strength is not particularly higher than that obtainable by cold working and galvanizing, but the yield point and modulus of elasticity are very markedly improved, the former being raised to 190,000 pounds per square inch without any sacrifice of elongation. This material of course must be studied under working conditions in order to compare its properties with those of the previous type. All indications point to a possible substantial increase in working load which can be handled with this process.

Future of Bridge Wire

Mr. Moiseiff has referred to the improvement which has taken place in structural steel for bridge work, particularly in regard to the use of alloys and heat treated material. Improvement due to heat treating of steel has made such rapid strides in recent years throughout the automobile and machinery fields that this source of increased strength should logically be further developed for bridge work. Heat treated eye-bars of larger dimensions are now in use and appear to fulfill the requirements. In the case of wire, the small section and continuous production add immeasurably to the ease and continuity of heat treatment and with the adaptation of special methods of test we believe that reliability is as great or greater than that obtained in the usual way.

In regard to possible secular changes mentioned by Mr. Moiseiff, we can point to very old examples of heat treated materials in the use of arms and armor. There are in existence plenty of heat treated tools which have not, as far as we know, changed their properties in many hundred of years. Of course, direct confirmation is impossible as the original properties were not measured in exact terms and are even now difficult to make complete. Probably one hundred years from now heat treated wire will be cut from bridges and re-tested to determine what changes have taken place.

Changes due to aging are marked in the cold drawn materials. Fortunately the change is always in the direction of higher strength although at the expense of ductility. This is to be expected from a material hardened by cold work and therefore in unstable equilibrium and filled with internal stress.

We quite agree with Mr. Moisseiff in his desire for better knowledge of high-strength steel, better methods of test which will increase our confidence in this material and allow an increase in the working loads, which in turn will make it possible to build longer and lighter bridges than have yet been contemplated.

DIGEST OF RECENT TRADE LITERATURE

Anaconda Puts Large Hoist in Service. Engineering & Mining Journal, June 8, 1928. P. 79.

The description of this large new equipment gives a good idea of the wire problems in mining work. This new chippy hoist of the Anaconda Copper Mining Co. at Butte, Mont., has a wire diameter of 1⅞ in. The rope weighs 28,900 lbs. for the 5,200-ft. depth, operates at a maximum speed of 2,250 ft. per minute, while the skip weighs 10,500 lbs., the skip cage 4,000 lbs., and a load of ore weighs 14,000 lbs. This gives total weight, loaded, of 57,400 lbs., which is moved from a depth of 5,200 ft. up to sea level in 152 seconds. Naturally, the wire which does this exceptionally severe work is of unusual quality.

Steel Must Advertise. Printer's Ink, June 7, 1928, P. 167.

In an editorial this journal for advertisers says it "has long maintained that the basic industries have as much or more reason and necessity for advertising as the so-called converting industries. The present century has seen great changes in the markets for basic commodities with the consequent shifting of volume from one industry to another. Only the fact that the country's capacity to consume has grown by leaps and bounds has made this shifting less noticeable and less pinching to certain industries than would have been the case if consumption had increased less rapidly of its own accord.

Today the steel industry is faced by competition from the producers of copper and substitute products and only the fact that manufacturers outside of the industry have constantly been discovering new uses for steel has made it possible for the steel manufacturers to continue on their way blind to their lost opportunities.

It is encouraging to note that leaders in the steel industry both at home and abroad are realizing the necessity for some kind of co-operative effort to increase the sale of steel. It is even more encouraging to note that they almost automatically consider advertising one of the means to increased sales. It was not so many years ago that the leaders of most of the basic industries regarded advertising with a *hauteur* that was as discouraging as it was unjustified.

The steel industry eventually will have to follow the suggestions of its more far-sighted leaders. The sooner the industry turns to a sound advertising policy the sooner will it find itself in a position to solve some of its most vexing problems."

Mumetal Increases the Speed of Cabling. Engineering & Mining Journal, April 12, 1928. P. 774.

An example of what good sound research can do to make better business. For use in submarine cables, a wire was needed with a low mu coefficient so that the impulses would pass more rapidly. This was worked out in the form of a wire of nickel iron made by electric melting in Europe. A typical analysis of the metal is nickel 74.0%, iron 20.0%, copper 5.3% and manganese 0.7%. The magnetic permeability of this material is 7.000. Wire of this nickel iron has increased the speed of cabling some seven or eight times. Because of its low mu coefficient it has been named mumetal.

Trade Literature Received

"Nichrome and Other Alloys", Driver-Harris Company, Harrison, N. J. 64-page illustrated booklet describing the properties and characteristics of several alloy wires for electrical resistance and heating purposes. Contains useful data and charts for determining resistance at various temperatures and for estimating on special requirements.

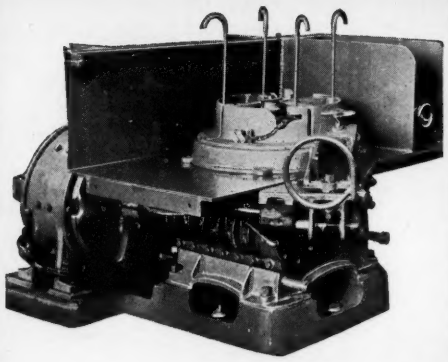
"How Buffalo Wire Products Stand Guard Day and Night." Buffalo Wire Works Co., Buffalo, New York. 16-page illustrated booklet outlining the growth of the company and introducing the present executive personnel. Briefly describes the main items in a line that includes over a thousand different kinds of wire products.

"The Design of Lighting Installations". Westinghouse Lamp Company, 150 Broadway, New York City. 44-page illustrated booklet of information required for making lighting layouts for all the more usual types of installations. Contains lighting calculation data for industrial, commercial and public interiors, display and flood lighting. Charts, diagrams and formulae cover equipment, outlets, determination of lamp power and sizes, wiring guide and reflecting equipment.

"Diversify and Follow the Path to Plenty". Kokomo Steel & Wire Company, Division Continental Steel Corporation, Kokomo, Indiana. 64-page illustrated booklet of constructive recommendations for successful diversification in modern farming. Describes and illustrates practical applications of the company's farm and poultry fence. Specifications, layouts and tabulated data enable the purchaser to make intelligent selections and estimates.

"Some Pertinent Facts About Diamond Dies". Diamond Die Company of America, 421 Seventh Avenue, New York City. Folder describing the essential features of diamond wire drawing dies with brief notes on settings, recutting, scrap value, weights and service.

VAUGHN



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THE MOTOBLOC has completely revolutionized former costs and production schedules in the wire mill industry. Production has been actually increased 20% to 100% over the usual methods.

The most outstanding characteristic of the MOTOBLOC is its flexibility — resulting in greatly increased drawing speeds, increased production per operation, less scrap, less floor space per unit of production, greater safety and lower cost of wire.

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THE Vaughn Continuous Wire Drawing Machine shown above is the newest development in drawing of copper wire.

It is the most compact wire drawing unit ever designed, requiring but half of the floor space ordinarily required and with a remarkable production from one and one-half to two times the equipment you now use.

These machines are manufactured under a license from the Western Electric Company, Inc., by which certain exclusive rights have been acquired.

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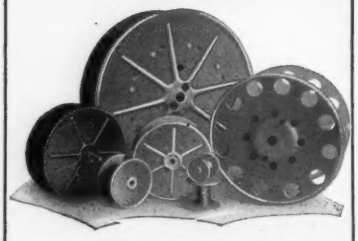
Steel Spools and Reels for Wire Work



Throughout the wire industry pressed steel spools and reels are becoming recognized as real money savers.

If you contemplate modernizing your equipment, let APCO MOSSBERG engineers submit some figures to you.

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EDITORIAL BY-PRODUCTS

Mr. Hoover Knows His Metals

ANNOUNCEMENT of Mr. Hoover's nomination for the Presidency reminded us of a half-forgotten contribution of his to the lore of metallurgy which we have just been rereading in the vain hope of finding in it something about the historical side of wire drawing. We refer, of course, to the notable translation that he and Mrs. (Lou Henry) Hoover made of the ancient treatise by Georgius Agricola entitled "De re Metallica". As the translators pointed out in their foreword—their book was published in 1912—the original Latin version, printed in 1556, was for over one hundred and eighty years a text book and guide to miners and metallurgists.

The stout volume is illustrated with reproductions of the German author's quaint drawings describing "the development of mining methods, metallurgical processes, geology, mineralogy and mining law from the earliest times to the 16th century". Methods, practices and formulae long since superseded are reported in detail by Agricola, who was a physician by profession and only followed metal working as a hobby. When personal observation failed him, he, nothing daunted, described his processes as "I conjecture them to be".

Wire drawing, unfortunately, is neglected, but there are weird and wonderful stories of ore extraction, heat treatments and alloy manufacture, mixed with quotations from the classics, medieval superstitions, and rules and regulations for everything from locating ore deposits with the divining rod to the recommendation of a heavy butter diet to offset the effects of foundry fumes.

The Hoovers spent their spare hours for five years translating this unique work from the Latin original, annotating the text and verifying sources. "If", they wrote in their introduction, "the work serves to strengthen the traditions of one of the most important and least recognized of the world's professions we shall be amply repaid." And so, we might add, will the reader with a taste for the curious lore of metals.

Why Price Cutting Hurts Industry

THE tragic result of price cutting in the galvanized steel industry was one of the points made in an address before the National Association of Flat Rolled Steel Manufacturers by O. H. Cheney, vice-president of the American Exchange Irving Trust Company. He showed how copper, asbestos, slate, composition tile, and even paper stepped in and took a big share of the business from the galvanizers because they began skimping more and more on the coating. Price competition led to lower and lower quality until the gates were wide open for competing industries to obtain a huge share of the business.

One manufacturer, as an illustration, spent $150,000,000 in five years and as a result has been able to cut the average cost of production per ton of finished steel by $7.27. But what happened to that $7.27? The average billing price of this company per ton of its finished steel has gone down $8.60 in the same five-year period. Did this steel producer pay $150,000,000 for the privilege of giving away $1.33 with every ton of steel? Mr. Cheney concludes that the great bugbear of price cutting is that it does not increase the volume of industry but wipes out the profits on what volume it has, and finally, more creative selling and less volume chasing would solve the steel problem.

The Mechanical Testing of Wire

(*Continued from page 226*)

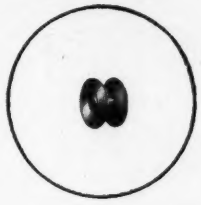
This makes it more exclusive to wire and narrow steel strip. It will be noticed from the photograph that the machine is of good clean design and is easy to operate.

Another type of 6,000 lbs. capacity machine, while being also of a single lever type, differs in that it is hydraulically controlled. This machine works with the town's main water supply at 30 lbs. and upwards per square inch. A much greater quantity of work can be got through in a day than when the stress is applied by hand. The stand, shown bolted on to the base plate, carries two valves with vernier shafts and hand wheels—one for pressure and one for exhaust. The larger hand wheel on the machine bracket is for travelling the poise weight along the beam to meet the stress upon the specimen. The propulsion of this poise weight is through screw gearing. The gripping devices both have open fronts to save time in inserting the wire and consist of two pairs of levers which are brought into position by gearing. The maximum distance between the grips is 9 inches and the minimum distance 5 inches.

200-lb. Machines

In the 200 lbs. capacity class there are very few really good types of testing machines. The reason for this is, that to get a really accurate and yet robust testing machine of this capacity, necessitates that the machine should be more of the class of scientific instruments than a commercially made machine. Fig. 3 represents a machine of American construction and differs from practically all other types of testing machine of this capacity, in that it depends upon an entirely different principle for balancing the load. The machine consists of one travel-

2½ INCHES *or* 8 FEET



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Made in standard types from 2½ inches in diameter to 8 feet. Special Reels or Spools to your specifications. Write for catalog.

"AMERICAN" Pressed Steel Reels and Spools are practically indestructible. More easily handled because they are *balanced.* Stronger and more rigid because of their unique design of pressed steel. *Always true to gauge* as specified — they are made with the same precise, honest workmanship as are "American" Belt Pulleys and Shaft Hangers.

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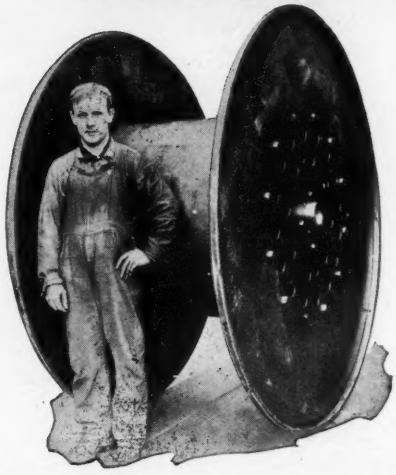
AMERICAN PRESSED STEEL REELS



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Oakite Service Men, cleaning specialists, are located in all the leading industrial centers of the United States and Canada

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ling stage actuated by a hand-wheel and one very slightly travelling stage, which is attached by means of a thin piece of high tensile steel strip to a hanging weight. The pull that is put on the specimen operates a lever which tends to raise this weight through an arc of a circle. Attached to this lever there is a pointer carrying a vernier scale which moves through another arc and across a scale.

The machine weighs automatically all loads up to 12 lbs. by 2 oz. increments and on the same continuous scale by 1 lb. marks from 12 lbs. to 200 lbs. The pointer and weight remain stationary at rupture of the specimen and record the maximum load. The grips are of good design for the testing of light wires and will hold without damaging the surface of the wire up to the capacity of the machine.

Another type of machine of this capacity which is very sensitive, accurate, robust and easily operated, is shown in Fig. 4. This is just an ordinary type of testing machine of the single lever variety but on a very small scale. There are no loose weights and the poise weight carries a vernier and is propelled by a screw and suitable machine cut gearing. The grip housing is open fronted and the wedge suitable for wire.

Testing

The testing of hardened and tempered wire appears at first sight to be a simple matter, but there are one or two small details which must be carefully watched, otherwise accuracy cannot be maintained. It is of the utmost importance that the device for gripping the wire shall be such that the skin shall not be damaged to any great extent. The wire certainly must be gripped, but not bitten, for it must be remembered that the portion of wire which is held by the grips is of the same diameter as the portion under test between the grips. Should the wire be in any way cut by the

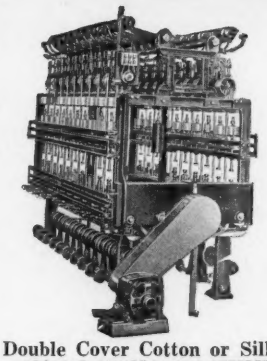
grips then fracture will occur in the grips and an unsatisfactory test will result. The usual type of grip consists of a pair of wedges which move simultaneously in a tapering slot. The wedges move in guides, so that, as they move towards the broad end of the slot their faces gradually get farther apart. The faces of these wedges are the all-important part. They must have a surface akin to a well-cut, smooth file, and yet not have its cutting edge.

Grips Important

The grips should be made of a good quality steel; they may be roughly forged into shape prior to machining, after which they should be cut with serrations of the requisite depth and finally case-hardened. Another matter of importance is that the pull should be as nearly straight as possible. In machines of modern manufacture for wire-testing the grips vary in width from 1½ inches to about 3½ inches, according to the capacity of the machine, and it is easily possible to put a wire in one side of one grip and the opposite side of the other. Under such conditions the result of a test would be on the low side.

The general procedure of a test is to put on about ¾ of full load rapidly, and to put on the remaining ¼ gradually. After the material has begun to stretch appreciably, the loading should be applied rapidly and the beam kept floating by slight movements only of counterpoise until fracture occurs. On no account should the counterpoise be run back after the beam has dropped finally, otherwise the breaking load will be that of the strength of the reduced area of the neck of fracture.

The whole test should not occupy more than ten to fifteen seconds, during which the majority of the loading takes place in the first five or so seconds. If the loading of the wire be too rapid then a higher result will be obtained than if the above



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Forms Eleven Sizes of Eyes from Round, Square, Flat or Half-Round Stock, also almost any shape desired Quickly and Efficiently.
Adjustable for No. 3 to No. 24 Gage Wire.
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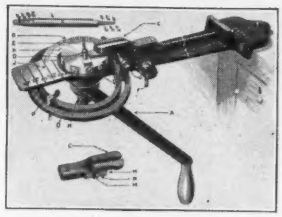

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Wire Drawing Soaps and Compounds
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Netting Pinions for Wire Netting Machinery
(For hexagon and triangular netting) made from a Special Steel of about 70—80 kg solidity, and
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First class workmanship, in all sizes wanted, as per sample or drawing.
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of a firm of diamond die specialists which is not interested in manufacturing and selling anything **BUT** diamond dies.

EXPERIMENTING with new brands of Dies costs too much. Better use dies that have been tested and preferred for 38 years.

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suggestions be carried out; the increase might be as much as 5% to 8% of the true load.

The length of test piece is also a factor which determines whether a true breaking stress is recorded or not. A very short test piece will nearly always give a slightly higher breaking stress because the short length is stretched at a relatively higher speed than a longer test piece.

It has been definitely established by a test, that will be described later, that a wire will stand a higher load than its breaking stress without fracture for a very small fraction of time. So, in wire testing, not only must the operator bear in mind these points but he must be thoroughly acquainted with the machine. Practice makes for rapidity and accuracy.

The ordinary tensile strength test is usually only one to determine the breaking load, but occasionally it is necessary to determine in addition the elastic limit, the yield point, and the percentage elongation and reduction of cross-sectional area.

The Elastic Limit and Yield Point give information as to the heat treatment and chemical composition, and the elongation and reduction show whether the material possesses the requisite ductility or not.

Springs From the Designer's Point of View

(*Continued from page 228*)

spring of 1″ or larger square wire with a business-like and comfortable appearance.

And it is also a fact that a great many springs do not have to be closely designed as to height at operating or maximum load, initial or total. It is generally an unusual condition where the amount of deflection happens to require coincidence of certain heights with certain loads. Ordinarily it is simply a matter of providing adjustment so as to get the required load.

If the problem requires 2 exactly specified leads to coincide with 2 exactly specified heights then the problem becomes slightly more intricate, requiring a calibrated spring. The degree of exactness required will govern the cost of the spring. As load versus deflection vary directly, a load deflection curve is not a curve at all, but a straight line. Therefore it is possible to design and calibrate a spring to any number of given loads coinciding with an equal number of given heights in the manner indicated in Chart No. 1.

The method to follow is to keep the load points the same and vary the deflection points until the proper coincidence is arrived at. This is done by changing the ratio of D/d or size of wire, (and again D/d), until the exact points coincide without too much change from the previously determined stresses decided on due to long-life factor of spring Duty classification. LAY IT OUT, but first of all be sure you know what load you have to have. Remember that as the load increases, becomes greater, the deflection becomes greater starting from zero deflection, and the spring becomes shorter.

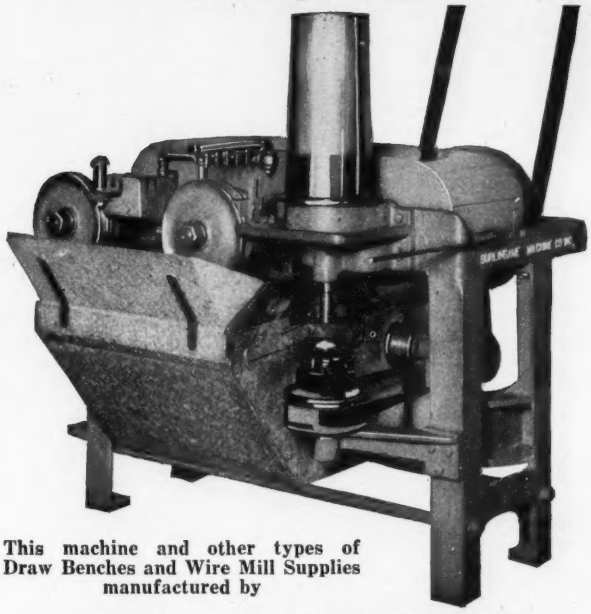
In the case of extension, (stretch), springs, they are at the point of zero deflection when solid, and as the load increases they become longer. They may be designed by the same method after spotting the initial load if any is required.

Hints on Design

As the load is the *beginning* of spring design it is obvious that it is necessary to adjust for deflection where a certain initial load is required.

Do not expect compression springs to follow exactly straight lines on the load-deflection curve at the very beginning and end of compression. Design so the initial load is at over 10% of total deflection. Also do not try for a fine calibration in the last 10% of total deflection unless the spring is to be extremely well made. In other words, accomplish the require-

Continuous Wire Drawing Machine
6 Draft Liquor Finish
For Drawing Fine Wire



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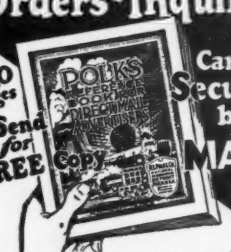
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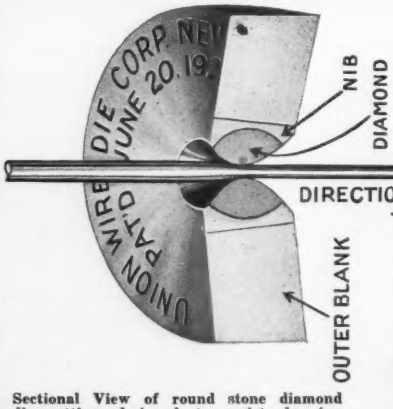

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ments in the range lying between 10% and 90% of total deflection. Simply project the graph to a greater *solid load* and greater *free height*. See Chart No. 2.

The irregular ranges indicated are more noticeable in hot wound springs of the heavier wires, (¼" or over), and especially in forged springs of round or square shape, particularly if poorly coiled or manufactured by methods not up-to-date. They no doubt exist, more or less, in any springs, however made, and it would be just as well for the designer to keep the idea in mind in all spring problems. The Regular Load versus Regular Deflection line, when plotted and projected, will give the normal designed solid load and corresponding solid height.

Springs should always be mounted so that the face-to-face measurement can be made any time when the device is in operation. This measurement is used to determine the load on spring provided it is compressed enough to be within the range of regular straight line deflection.

Provide as much spring space as possible consistent with good design, I. D. and O. D., as you may desire in the future to increase the Duty and therefore the long-life factor. *Volume* represents long life for springs as well as available duty.

Government Fence Specifications Arouse Protest

(*Continued from page 223*)

the Bureau of Standards or the Department of Metallurgy—have apparently decided that the specifications were the best to use for fence specifications; that they have apparently invited every principal manufacturer in the country and that after they had made exhaustive tests on their various metals and types of fences, the Bureau of Standards are now moved to come out with these tentative specifications with a recommendation that every one confine their

purchase to this line of product. This puts us, or any other independent manufacturer, decidedly in an injured position.

"We are of the opinion that the fundamental thought in the founding of your Department or the establishment of Simplified Practice was to avoid waste and to establish uniform practices within the industry. For instance, in the Metal Sash Manufacturers Specifications if does not specify the kind of metal, how it is assembled, etc., but confines itself solely to establishing uniform sizes. That is a decided advantage which is passed on ultimately to the consumer. It is an aid to architects, builders, and everyone interested in the trade. It establishes just what sizes can be gotten from any manufacturer from stock and just what sizes are special.

Apparent Discrimination

"The chain link specifications go many steps further than this." The letter adds that the character of construction is limited to the standard product of the principals of the association meeting at Cleveland January 19, that the amount of copper-bearing is carefully specified and carbon content also, following very closely, the letter says, the specifications of certain competitors present at the meeting. It refers to the requirement that if anchors are furnished, "they must be steel" and asks "why should they be different when used with a pipe post which under the specification would have to be copper bearing?"

"The answer," it adds, "is obvious to us. Practically every item throughout the specifications reads like a composite catalogue and sales argument for a certain product. Even the illustrations are representative drawings of two types of manufacture. We hold the specifications as written as being highly discriminatory."

The letter asks that "the Secretary (Mr. Best) of the Chain Link Manufacturers be stopped immediately in circulating this propaganda."

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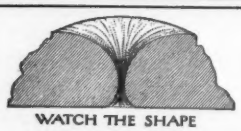

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Domestic Exports of Iron and Steel Wire, Wire Rope and Nails, From the United States, By Countries
April, 1928

Countries	Plain iron or steel wire	Galvanized wire	Barbed wire	Wire rope	Insulated iron or steel wire and cable	Wire nails
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Belgium	2,218	.....	.....	.....	.....	.....
Finland	500	.....	.....	.....	.....	.....
France	500	.....	.....	.....	.....	.....
Germany	1,337	45,030	.....	.....	.....	.....
Italy	.....	.....	.....	.....	.....	436
Norway	500	.....	.....	1,730	.....	140
Portugal	1,102	.....	.....	.....	.....	4,520
Soviet Russia in Europe	360	.....	.....	85,137	.....	.....
Spain	780	6,781	.....	.....	.....	.....
Sweden	1,200	.....	.....	.....	.....	.....
Switzerland	1,258	.....	.....	.....	.....	.....
United Kingdom	44,588	73,435	11,200	.....	1,274	53,861
Canada	600,398	3,315,517	821,550	44,181	7,691	15,702
British Honduras	.....	.....	170	333	.....	1,400
Costa Rica	5,300	.....	29,735	.....	.....	300
Guatemala	400	.....	167,340	6,500	.....	22,860
Honduras	1,822	200	112,000	891	.....	46,877
Nicaragua	504	30	25,360	2,541	419	20,200
Panama	1,000	11,000	88,850	23,809	.....	51,125
Salvador	.....	845	.....	.....	.....	2,447
Mexico	225,700	129,680	1,648,863	92,004	4,358	57,998
Newfoundland & Labrador	112,100	1,895	2,000	.....	.....	700
Bermudas	300	1,142	.....	475	1,014	.....
Barbados	.....	.....	.....	.....	481	.....
Jamaica	.....	.....	.....	507	.....	105,728
Trinidad and Tobago	400	.....	.....	.....	120	5,000
Other British West Indies	500	5,815	.....	920	700	11,600
Cuba	34,805	38,548	1,110,395	50,342	900	267,555
Dominican Republic	4,243	.....	108,000	947	80	75,400
Netherland West Indies	3,307	800	1,510	7,681	.....	38,705
Haiti, Republic of	6,647	1,000	4,800	.....	.....	36,468
Virgin Islands of U. S.	.....	50	5,600	81	.....	5,900
Argentina	650,711	190,797	2,852,409	3,066	.....	2,800
Bolivia	.....	.....	.....	4,932	.....	528
Brazil	37,177	152,762	5,653,210	1,580	17,859	.....
Chile	3,282	52,470	100,089	17,111	.....	516
Colombia	112,233	130,426	779,305	2,601	55	386,188
Ecuador	700	.....	.....	.....	1,965	36,219
British Guiana	200	.....	.....	.....	164	.....
Surinam	.....	.....	.....	216	.....	.....
Paraguay	.....	.....	.....	.....	.....	1,102
Peru	32,009	135,600	4,000	12,126	.....	100,823
Uruguay	.....	142,884	22,046	.....	.....	.....
Venezuela	4,828	1,500	283,353	20,249	2,724	24,597
British India	350	.....	56,000	1,232	.....	.....
British Malaya	53	.....	.....	17,619	.....	9,920
China	.....	336,501	.....	.....	.....	1,853,408
Java and Madura	10,036	2,535	108,025	9,976	.....	.....
Other Netherland W. Indies	745	200	65,367	58,569	.....	.....
Hong Kong	560	33,684	.....	1,010	.....	.....
Japan	2,660	10,769	.....	4,569	44,800	8,030
Philippine Islands	2,962	22,154	453,500	122,437	7,785	723,952
Soviet Russia in Asia	.....	315	8,000	2,925	.....	33,900
Turkey in Asia	.....	.....	.....	.....	.....	190
Australia	92,424	24,796	.....	.....	.....	.....
French Oceania	.....	202	.....	550	.....	200
New Zealand	4,819	134,520	.....	.....	.....	1,105
Union of South Africa	730	67,200	358,200	.....	.....	.....
Liberia	.....	.....	112	99	.....	.....
Mozambique	.....	.....	153,100	.....	.....	200
Other Portuguese Africa	3,625	.....	.....	.....	.....	.....
Total Quantities	**2,011,873**	**5,071,083**	**15,034,089**	**598,946**	**92,389**	**4,008,600**
Total Value	**84,365**	**143,376**	**413,903**	**84,782**	**9,959**	**111,551**

Shipments from the United States to Non-Contiguous Territories.

Alaska	.....	.....	.....	.....	.....	363,566
Porto Rico	75,154	40,959	226,500	14,129	2,529	361,987
Hawaii	13,816	123,266	11,664	31,434	5,920	75,645

April Exports Reveal No Definite Trend

FEW significent changes appear in the export tabulations for the latest available monthly period, April, as compared with March, which was the most active shipping month in the first quarter.

Exports of Plain Iron and Steel Wire showed a decrease of 71 tons as compared with the previous month, with Canada continuing to be the chief customer.

Shipments of Galvanized, most of which also went to Canada, fell off 1429 tons.

An increase of 1396 tons will be noted in exports of Barbed Wire. Brazil and Argentina took about two-thirds of the total.

Domestic Exports of Iron and Steel Wire Manufactures, Household Nails and Horseshoes From the United States, By Countries

April, 1928

Countries	Woven wire fencing	Woven wire Screen Cloth		Wire n. e. s. & manufactures of	Horseshoe nails	Horseshoes
	Pounds	Pounds	Dollars	Pounds	Pounds	Pounds
Belgium	.....	.....	.....	300	4,840	.....
Denmark	.....	.....	.....	2,454	.....	.....
Finland	.....	.....	.....	1,930	.....	.....
France	.....	.....	.....	35,932	.....	.....
Germany	.....	.....	.....	159	.....	.....
Italy	.....	.....	.....	8,572	.....	.....
Netherlands	.....	311	301	423	.....	.....
Norway	22,182	.....	.....	2,021	.....	.....
Poland & Danzig	.....	.....	.....	5,200	.....	.....
Soviet Russia in Europe	.....	8,747	1,190	.....	.....	.....
Spain	.....	.....	.....	248	.....	.....
Sweden	.....	.....	.....	26,751	.....	.....
Switzerland	.....	.....	.....	.....	4,620	.....
United King.	208,180	555	[1]	[1]	...	...
Canada	261,961	38,187	6,016	323,361	1,885	44,149
B. Honduras	.....	426	82	32	25	.....
Costa Rica	4,691	593	59	404	400	3,500
Guatemala	176	538	64	1,099	1,100	.....
Honduras	14,728	3,565	453	6,948	.....	.....
Nicaragua	483	3,057	394	235	160	400
Panama	1,144	1,475	160	5,547	340	.....
Salvador	.....	89	20	374	300	.....
Mexico	66,916	45,847	6,889	154,480	19,781	16,561
Miquelon & St. Pierre Is.	110	.....	.....	.....	.....	.....
Newfoundland & Labrador	1,558	1,675	446	1,661	.....	.....
Bermudas	1,580	597	69	607	.....	1,414
Jamaica	6,783	638	104	530	.....	.....
Trinidad & Tobago	1,251	3,661	1,309	665	.....	.....
Other B. W. Indies	190	102	25	.....	.....	.....
Cuba	177,506	12,889	2,122	25,013	.....	.....
Dom. Rep.	7,700	193	74	3,848	89	900
Netherland W. Indies	32,418	4,525	1,001	76,541	.....	.....
Haiti, Rep. of	1,064	2,607	366	357	50	.....
Virgin Is. of U. S.	300	1.590	281	.....	.....	300
Argentina	.....	2,282	454	4,569	6,174	.....
Bolivia	.....	.....	.....	402	.....	.....
Brazil	.....	.....	.....	3.697	.....	.....
Chile	9,330	873	94	8,977	10,490	.....
Colombia	11,470	5,060	726	3,982	83.184	.....
Ecuador	.....	.....	.....	301	3,000	.....
Surinam	.....	540	56	.....	.....	.....
B. Guiana	.....	.....	.....	158	.....	.....
Peru	1,500	2,448	288	30,602	7,500	706
Uruguay	.....	1,577	296	105	.....	.....
Venezuela	3.202	2,958	1,011	1,442	5,575	.....
B. India	179,798	813	151	692	12,015	.....
B. Malaya	.....	4,325	879	2,856	.....	.....
China	28,140	1,228	546	83,523	.....	.....
Java & Madura	.....	.....	.....	1,251	.....	.....
Other Netherland E. Indies	906	.....	.....	680	.....	.....
Hong Kong	.....	.....	.....	800	.....	.....
Iraq.	.....	.....	.....	822	.....	.....
Japan	50,484	884	458	141,982	30,000	.....
Kwantung	.....	.....	.....	1,139	.....	.....
Philippine Is.	70,220	8,106	1,161	6,064	.....	.....
Siam	1,702	.....	.....	.....	.....	.....
Soviet Russia in Asia	512	.....	.....	.....	.....	.....
Australia	4,279	15,166	2,694	113,746	18,300	.....
F. Oceania	.....	150	96	78	.....	.....
New Zealand	.....	200	28	4,965	8,837	.....
Union of S. A.	887	5,687	952	1,608	112	.....
B. W. Africa	340	.....	.....	.....	.....	.....
Liberia	345	3,826	1,509	.....	.....	.....
Mozambique	9.640	683	135	.....	.....	.....
Total Quantity	**1,183,676**	**188,678**	.....	**1,116,229**	**218,777**	**67,930**
Total Value	**64,119**	.....	**33,055**	**116,371**	**24,033**	**4,918**
Shipments from United States to						
Porto Rico	60,364	16,952	2,024	17,435	2,750	21,507
Hawaii	77,401	10,133	1,751	94,815	2,810	12,379

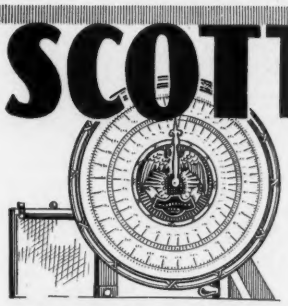
Both Insulated Wire and Wire Rope show a negligible decrease as compared with March.

China was the largest customer for Wire Nails, April exports of which exceeded those for March by 688 tons.

Little change is apparent in the Woven Wire Fencing figures.

Canadian and Mexican shipments account for the biggest items in the 104 ton increase in Screen Cloth, and Manufactured Wire Products, which ran off 546 tons as compared with the month before, went principally to Canada, Mexico, Japan and Australia, in the order named.

SCOTT



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Vaughn Machinery Co., Cuyahoga Falls, O.

CLEANING COMPOUNDS

Oakite Products, Inc., N. Y.

CRANES

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Vaughn Machinery Co., Cuyahoga Falls, O.

DIES—Chilled Iron

The Waterbury Wire Die Co., Waterbury, Conn.

DIES—Diamond

Bellet & Bouvard, N. Y.
Cochaud Wire Die Co., New York.
Diamond Die Co. of America, N. Y. C.
Driver-Harris Co., Harrison, N. J.
F. Krause & Co., Inc., Jersey City, N. J.
Union Wire Die Corp., New York, N. Y.
Urdika Wire Die Co., N. Y. C.
Vianney Wire Die Works, New York.
The Waterbury Wire Die Co., Waterbury, Conn.

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Cochaud Wire Die Corp., New York
F. Krause & Co., Inc., Jersey City, N. J.
Urdika Wire Die Co., N. Y. C.
Vianney Wire Die Wks., N. Y.

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FURNACES—Wire Annealing

Vaughn Machinery Co., Cuyahoga Falls, O.

GAUGES—Wire

A. Waldeck & Co., Cleveland, Ohio.

LATHES—Die Reaming

Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

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Watson Machine Co., Paterson.

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MACHINERY—Panning

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Riehle Bros., Phila., Pa.
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MACHINERY—Winding

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Burlingame Machine Co.
Kratos Wks., N. Y. C.
Morgan Construction Co., Worcester, Mass.
M. A. Irmischer, New York.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
The Vaughn Machinery Co., Cuyahoga Falls, Ohio.

NEUTRALIZING COMPOUNDS

Oakite Products, Inc., N. Y.

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American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

PRESSES—Rivet & Bolt

M. A. Irmischer, New York.

SOAPS—Wire Drawing

R. H. Miller Co., Homer, N. Y.

SPOOLS—Wire & Cable

American Pulley Co., Philadelphia, Pa.
Apco-Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TRUCKS

Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

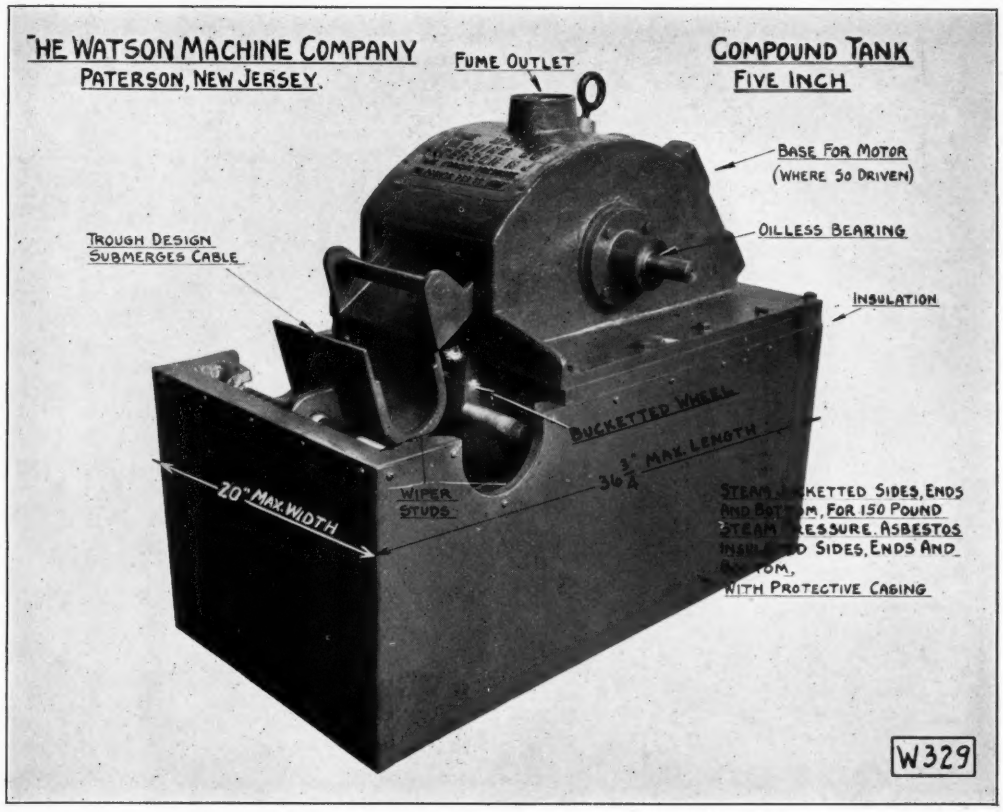
This is a carefully classified index of concerns who specialize in this industry and who advertise regularly in WIRE & WIRE PRODUCTS. Please mention WIRE when writing to these firms.

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

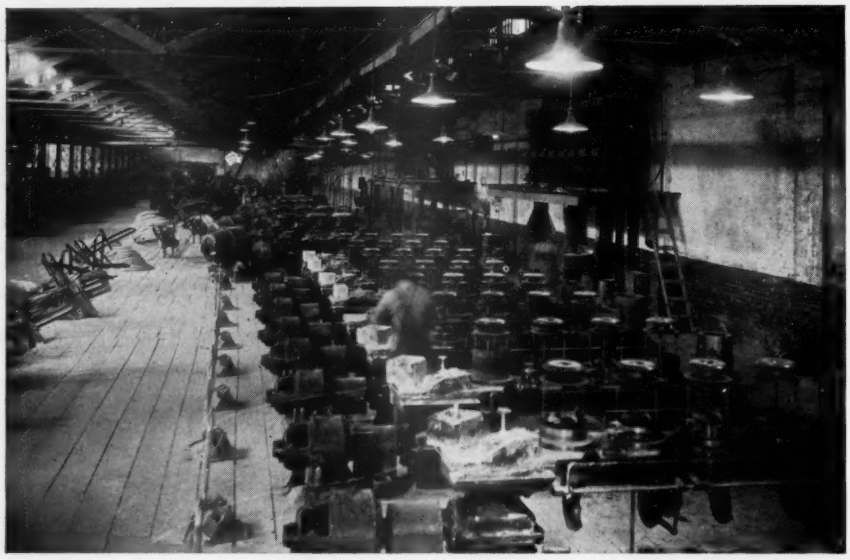
ENGINEERS - FOUNDERS - MACHINISTS



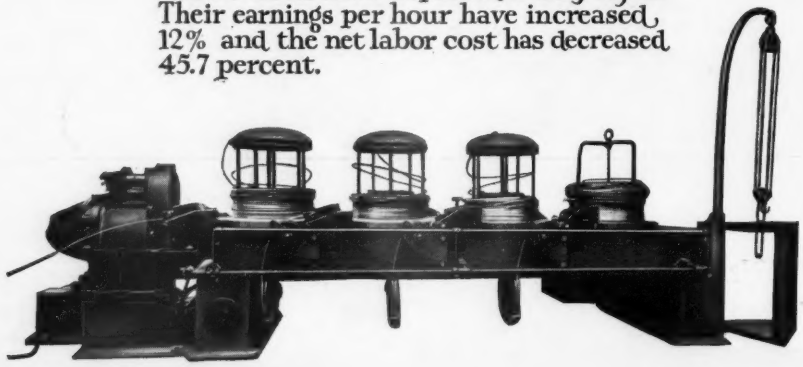
Tank For Saturating Operations In Machines

ELECTRICAL WIRE AND CABLE
WIRE ROPE and CORDAGE MACHINERY

MORGAN
WORCESTER
ENGINEERS AND MANUFACTURERS



Through this installation of
Morgan Connor Wire Machines
twelve men have replaced *twenty-eight.*
Their earnings per hour have increased 12% and the net labor cost has decreased 45.7 percent.



MORGAN CONSTRUCTION CO.
WORCESTER, MASSACHUSETTS, U.S.A.